4

Science Standard 4.2.c.

Supporting Materials

California Education and the Environment Initiative

Life and Death with Decomposers

D R A F T
for discussion purposes only

California Education and the Environment Initiative

ACKNOWLEDGEMENTS

The EEI Curriculum is a cooperative endeavor of the following entities:

California Environmental Protection Agency
California Integrated Waste Management Board
National Geographic Society
State Education and Environment Roundtable
California Department of Education
California State Board of Education
Office of the Secretary of Education
California Resources Agency

Project Managers for the Education and the Environment Initiative:

Andrea Lewis, Assistant Secretary
Cal/EPA

Mindy Fox, Director
Office of Education and the Environment
California Integrated Waste Management Board

Funding for the development of this curriculum is provided through the generous support of the California Integrated Waste Management Board.
Additional funding is provided by:
California Energy Commission, Department of Conservation, Department of Toxic Substances Control, and State Water Resources Control Board.

CONTRIBUTORS

Author: **Becky Wike**
California Connections Author: **Bendan Blue**
Principal Consultant: **Dr. Gerald A. Lieberman**, Director, State Education and Environment Roundtable
Managing Editor: **Jennifer Rigby**, Director, The Acorn Group

Office of Education and the Environment
1001 I Street • Sacramento, California 95812 • (916) 341-6769
http://www.calepa.ca.gov/Education/EEI/

Contents

Assessments

Lesson 1 Breaking It Down

Activity Masters

Lesson 2 Decomposers and Scavengers

Visual Aids

Lesson 3 A Big Job for a Tiny Crew

Visual Aids

Lesson 4 Waste Not

Visual Aids

Lesson 5 Down on the Farm

Visual Aids

Lesson 6 The Benefits of Composting

Visual Aids

Name: _____

Multiple Choice: Select the best answer and circle the correct letter. (1 point each)

1. Which three are decomposers?
   a. earthworm, fungi, bacteria
   b. bacteria, yeast, mold
   c. scavenger, mold, sow bug

2. Living things that use chemicals to break down matter are called
   a. decomposers
   b. scavengers
   c. consumers

3. Decomposers in food chains
   a. are eaten by other consumers
   b. feed on dead plants and animal matter
   c. both a and b

4. How do decomposers help humans grow food?
   a. they release nutrients into the soil and make humus.
   b. they clean-up waste.
   c. both a and b

5. What would happen if there were no decomposers?
   a. dead animals and plant parts would still decompose.
   b. nutrients would not get back into the soil, water, and air.
   c. both a and b

Name: _____

Read each question and write a complete answer. (2 points each)

6. What are three ways that decomposers help forests and other ecosystems?

_____

_____

_____

7. Why does agriculture need decomposers?

_____

_____

_____

8. How does our wastewater management system use decomposers?

_____

_____

_____

9. How do our communities use decomposers to manage our garbage?

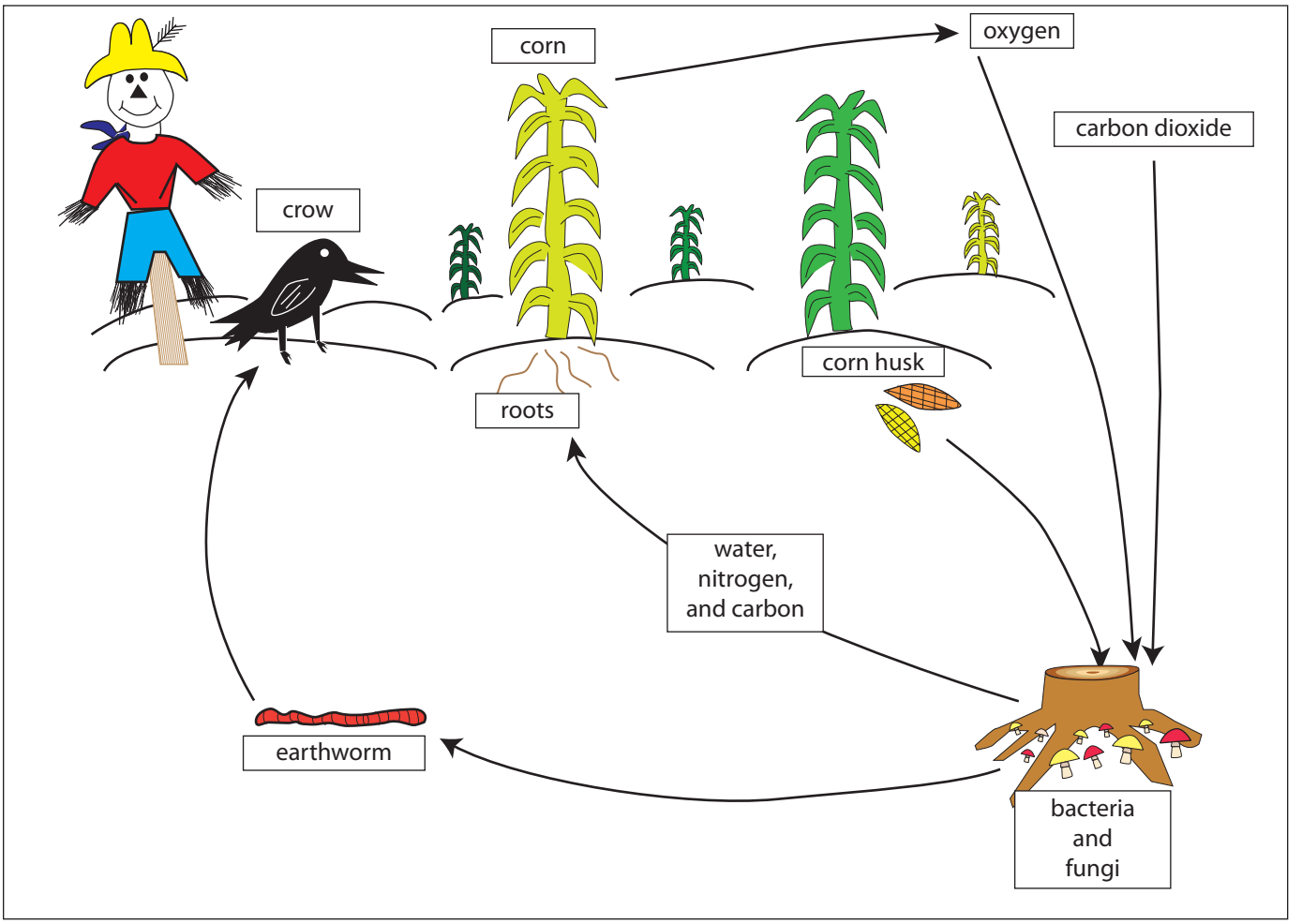
_____

_____

_____

Name: _____

Look at the diagram and then answer the questions. (2 points each)



10. Name two decomposers in the diagram.

_____

11. How are these decomposers connected to other things in this diagram?

_____

_____

12. How do humans depend on what is happening in this diagram?

_____

_____

Make a poster that shows the roles of decomposers and decomposition. First, choose an ecosystem. Then think about how you will show the following:

- **The decomposers in the ecosystem.** What do they look like? How big are they? Where are they found? What do they do?
- **How decomposers are part of the food chain.** What do decomposers eat? Who eats them?
- **What the ecosystem gets from decomposers.** What happens when decomposers do their jobs really well? What does the ecosystem get?
- **Why the decomposers are important to humans.** What do humans depend on from this ecosystem? How do the decomposers help?

Make sure you put your **name** and a **title** on your poster.

Here is how your poster will be scored:

Your Poster Shows	4 points	3 points	2 points	1 point
Parts of the Ecosystem	The diagram shows five or more organisms and parts of their habitats.	The diagram shows three or more organisms and parts of their habitats.	The diagram shows one or two organisms and parts of their habitats.	The diagram shows only the organisms. It does not include the non-living parts of their habitats.
Decomposers in the Food Chain	All organisms drawn are named and identified with labels that indicate their place in the food chain.	Many organisms are named and identified with labels that indicate their place in the food chain.	Most organisms are named and identified with labels that indicate their place in the food chain.	Fewer than half of the organisms are named and identified with labels that indicate their place in the food chain.
Decomposers in the Nutrient Cycle	Arrows are drawn and labeled showing where nutrients are released by all decomposers back into the ecosystem.	Many arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	Some arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	No arrows are drawn or labeled showing where nutrients are released by decomposers back into the ecosystem.
Human Practices That Rely on Decomposers	Poster identifies and describes more than two ways humans depend on the decomposers in the ecosystem.	Poster identifies and describes two ways humans depend on the decomposers in the ecosystem.	Poster identifies one way humans depend on the decomposers in the ecosystem.	Poster does not identify any ways humans depend on the decomposers in the ecosystem.

My Decomposition Poster is due on: _____ .

Wonderful Compost

The warm days of summer turn cooler. Tree leaves shake and rustle in the wind. It is October, and crisp red apples ripen on the trees. In the fall, Juliana Kelly loves to pick apples. Her family goes to an apple orchard every year.

The orchard is in the foothills of the Sierra Nevada Mountains. Its name is Apple Hill. Juliana picks sweet, red apples and puts them in her basket. She will eat the apples in pies, as a snack, and in her school lunch.

At home, Juliana helps her mother make apple pies for the neighbors. She carefully takes the core out of each apple. All of these apple cores have to go somewhere. Juliana has some choices. She can put the apple cores in the trash. A garbage truck will pick up the trash and take it to a landfill. Juliana has another choice. She can save the apple cores for the family compost pile.

Apple tree

Apple core

Juliana decides not to put the apple cores in the garbage. Instead, she adds them to the compost pile in her backyard. She throws the apple cores on top of the compost pile with other vegetable, fruit, and food scraps. Then she adds some grass from the lawnmower bag. She sprinkles some rich, black soil on top.

The apple cores and the cut grass soon begin to rot. Scientists use the word "decompose" to explain what happens to the food scraps. Tiny organisms live in the pile. Bacteria and fungi change the chemistry of the food, and break it down into nutrients that enrich the soil. Chemical decomposers are tiny. People need a microscope to see them.

Mites, pill bugs, snails, and springtails live in Juliana's yard. So do beetles, ants, flies, and earthworms. They all find their way to the compost pile. These physical decomposers or scavengers grind, bite, chew, and tear the food into tiny pieces. They work with bacteria and fungi. Together they turn the food scraps into compost.

Juliana knows that the decomposers need help. They must have water, air, and lots of food to make healthy compost. Juliana sprays her compost pile with water every few days. She uses a shovel to turn the compost pile. Turning the pile gives the decomposers a fresh supply of air. She also makes sure they have lots of fresh food scraps.

The compost is ready to use in a few months. It smells and looks like rich, healthy soil. Juliana puts the new compost in her garden. She mixes it with the soil. Then she plants pumpkin seeds and tomato seeds. She waters them well. Soon she will see tiny plants begin to sprout. Juliana will watch her pumpkins and tomatoes grow. Her family will begin to eat them when summer comes. Juliana will remember her

Apples in compost pile

compost each time she bites into a juicy tomato.

Juliana's mother takes a fresh apple to work. After she eats her snack, she puts the apple core in a covered box. In the box are hundreds of wriggling red worms. Tiny decomposers also live in Mrs. Kelly's box.

The red worms begin to eat the apple core. Their intestines are rich with juices. These juices break down the food. The worms leave behind droppings. The name for their droppings is "castings." Tiny decomposers will break down the castings and release vitamins and minerals. These nutrients are good for plants. Mrs. Kelly will use the castings to help her garden grow.

When a worm dies in the worm box, tiny bacteria go to work. They break down the carbon, nitrogen, and protein in the worm's body. Bacteria need carbon and nitrogen for energy. They need protein to grow and multiply. Decomposers like bacteria leave their own waste behind. This waste is rich in nitrogen, phosphorus, and magnesium.

"Vermicomposting" ("vermi" means worm) is the term for what happens when worms

Red worms feeding

Green waste collection

decompose food waste. Vermicomposting is a good choice for people who want to compost but do not have a big backyard. A box of special red worms takes little space. People can buy the worms online or at a local nursery. The worms need bedding like shredded newspaper. They need a steady supply of food scraps. They need someone to make sure their home doesn't get too wet or too dry. Many classrooms have worm bins. Sometimes students put the castings in their school gardens. Other students take the castings home for their houseplants.

Lucas Garcia is a young boy who lives in Alameda, a town near San Francisco. He does not have a garden. But he knows how to use his family's food scraps for compost. Lucas reminds his family to put their food waste in a special bucket by the sink. When it is full, he dumps it into a green waste cart outside the house. Mrs. Garcia puts grass into the green waste cart after she mows the lawn.

Each week Lucas pushes the green cart to the street. A special green truck picks up the Garcias' green waste. The truck stops at every house in Alameda. The green waste goes to one big composting place. There, decomposers and scavengers turn the waste into compost. Other cities send their green waste to the same place. California has so much green waste that it creates 4 million tons of compost each year.

Farms, vineyards, and orchards use the compost that Lucas helps the city make. Farmers in the Central Valley, Napa Valley, and Sonoma Valley add compost to their soil. They add compost to orange, avocado, and almond

Tractor turning compost pile

trees. Compost also helps grapes, tomatoes, and other crops. Farmers who use compost can water less. They can also cut back on use of chemical fertilizers, which can sometimes pollute the environment and make animals sick. Compost makes the soil and plants healthier. Using compost is good for farmers. It is also good for our land, food, and water.

Making compost means putting less in the garbage can. Less trash means fewer garbage trucks. This means less traffic and pollution. Less traffic and pollution can mean better air to breathe. Landfills will fill more slowly if people make less trash. Many landfills are built on open space that provides habitat for wild animals. When new landfills are built, habitat for animals is often destroyed. Finding new places to take our garbage is very difficult. Every person in California makes about 58 pounds of trash each month. You probably already recycle bottles, cans, and paper. How much less trash would you make if you made compost?

Juliana and Lucas feel good about composting their food waste. They use what some would call garbage to make soil healthier. They know that making compost with the help of decomposers is an important step. Their families and their friends can enjoy healthy food and safe water. Food grown in composted soil can improve the quality of life for all.


1. Bacteria


2. California condor

1. We are microscopic, one-celled organisms. You can't see us, but we are everywhere and we can break down almost anything.
(**Bacteria)**

2. I am a type of bird. My excellent eyesight helps me to find my food from far away. I eat dead animals.
(**California condor)**


3. Earthworm


4. Mold

3. My body is long, soft, and made up of segments. I tunnel through the soil and eat bacteria, fungi, and rotting plant parts.
(Earthworm)

4. I am a fungus. I am blue and gray in color. You can often find me on old food like bread and fruit, which I break down. I like damp places.
(**Mold)**


5. Mushroom


6. Millipede

5. I am a fungus. I often have a thick stem called a stalk and a cap that looks like an umbrella. I sometimes live on trees and other living things.
(Mushroom)

6. I have a rounded worm-like body, and I have many legs. I can be several inches long and come in a variety of colors. I eat rotting plants.
(**Millipede)**


7. Blowfly


8. Pill bug

7. When I am young, I am a maggot. I can smell dead animals from 10 miles away. I use chemicals to soften the food I suck up and eat.
(Blowfly)

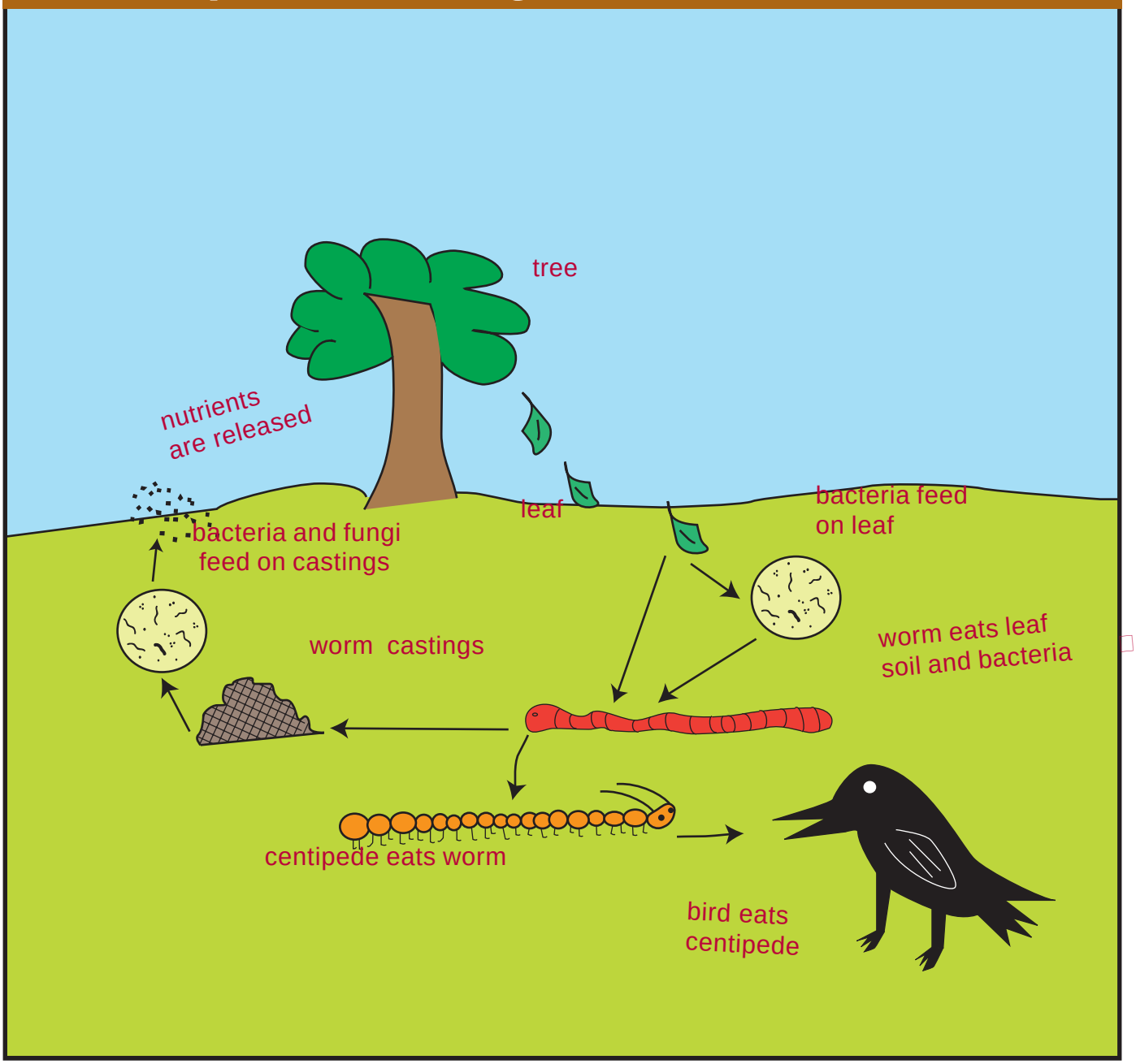
8. I have seven pairs of legs. I roll up in a ball when I am bothered. I like to eat leaves that have fallen off plants.
(**Pill Bug)**

Evidence of Decomposition

Evidence of Decomposition

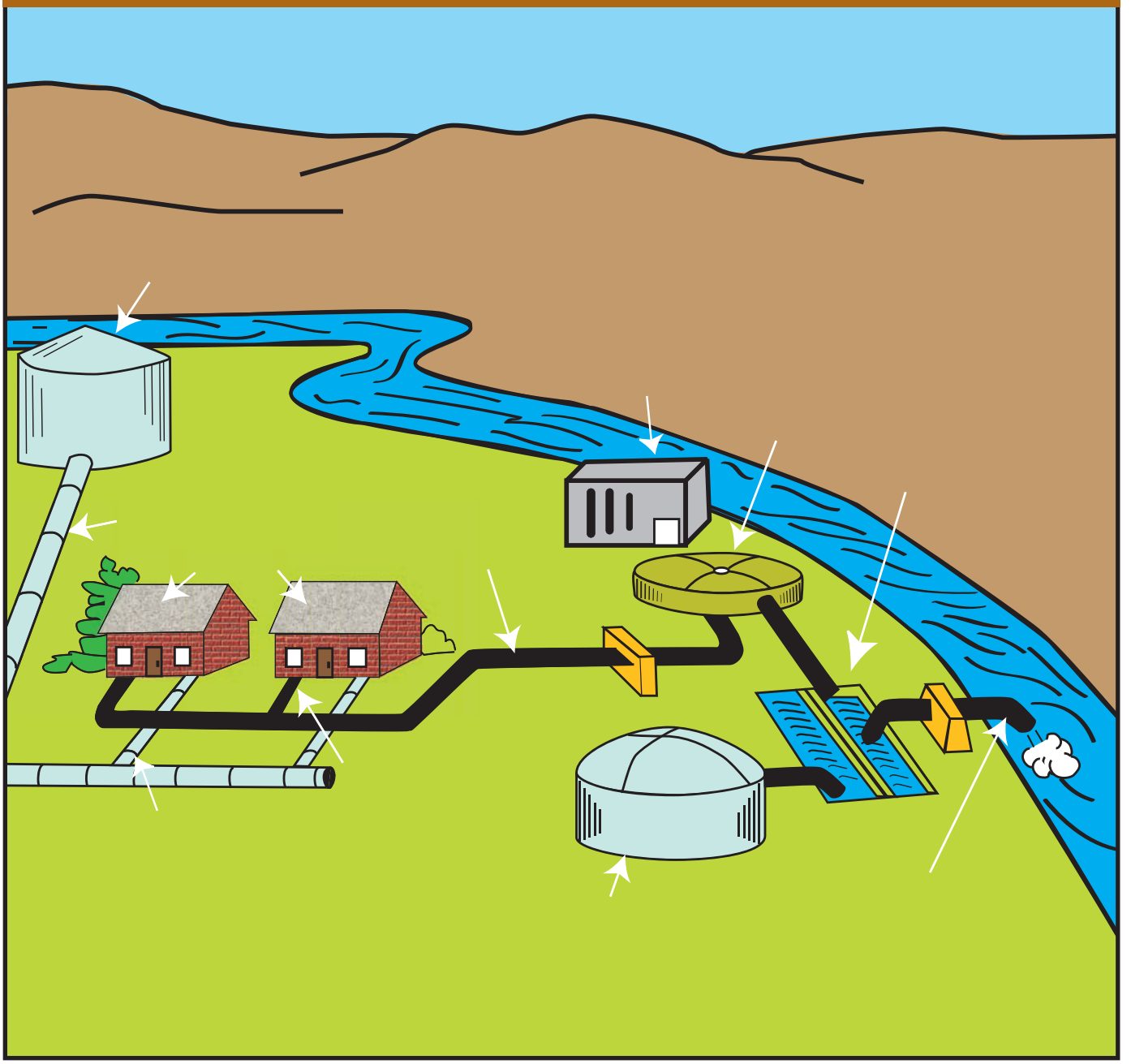
Evidence of Decomposition

Decomposition Diagram



Wastewater Treatment Plant

Wastewater Management System




Topsoil of the Central Valley


Topsoil of the Southern California Badlands


Landfill


Large Compost Facility

Credits

Editing Credits

Instructional Editors	Jayne C. Henn
Copy Editors	Laurel Singleton
Photo Editor	Jovi Radtke, Uptown Studios
Proof Reading	Michael D. Lieberman

Design and Production Credits

Original Design	Karol A. Keane, Design & Communications, Inc./National Geographic Society
Graphic Production	José Munguia, Creative Services, California State University, Sacramento
Printing	Graphic Communication Institute, Cal Poly, San Luis Obispo

Content and Educational Reviewers

Content	Lori Whalen, M.A.

Illustration Credits

Page 5	Decomposer Diagram – Jose Munguia, Creative Services, California State University, Sacramento
Page 23	Decomposition Diagram – Jose Munguia, Creative Services, California State University, Sacramento
Page 25	Wastewater Management System – Jose Munguia, Creative Services, California State University, Sacramento

Photo Credits

Cover	Vermicomposting – Suzanne Carter-Jackson/iStockphoto
Page 7	Apple tree – Lya Cattel/iStockphoto
Page 8	Apple core – Achim Prill/iStockphoto
Page 9	Apples in compost pile – Nathan Watkins/iStockphoto
	Red worms feeding – Suzanne Carter-Jackson/iStockphoto
Page 10	Green waste collection – iStockphoto
Page 11	Tractor turning compost pile – Hedda Gjerpen/iStockphoto
Page 12	Bacteria – Jane Hurd/National Geographic Society
	California condor – Kip Evans Photography
Page 14	Earthworm – Kip Evans Photography
	Mold – Brian Gordon Green/National Geographic Society
Page 16	Mushroom – Klaus Nigge/National Geographic Society
	Millipede – Joel Sartore/National Geographic Society
Page 18	Blowfly – Robert Clard/National Geographic Society
	Pill bug – Bianca Lavies/National Geographic Society
Page 20	Meat and bones – Bill Hatcher/National Geographic Society
	Vegetables – Chet Mitchell/iStockphoto
Page 21	Wood – Darlyne A. Murawski/National Geographic Society
	Bread – Brian Gordon Green/National Geographic Society
Page 22	Leaf – Peter Essick/National Geographic Society
	Fruit – Jessica Jones/iStockphoto
Page 24	Wastewater Treatment Plant – Kip Evans Photography

Photo Credits (continued):

Page 26 Topsoil of the Central Valley – Scott Leigh/iStockphoto
Topsoil of the Southern California Badlands – Jonathan Ling/iStockphoto
Page 27 Landfill – Pete Ryan/National Geographic Society
Large Compost Facility – Kansas State University, Research and Extension


THE GREAT SEAL OF THE STATE OF CALIFORNIA
EUREKA


CALIFORNIA
E
E
I
Education and the Environment Initiative


NATIONAL
GEOGRAPHIC